Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

November 17, 2020

10 CFR 50.73

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Browns Ferry Nuclear Plant, Units 1 and 2
Renewed Facility Operating License Nos. DPR-33 and DPR-52
NRC Docket Nos. 50-259 and 50-260

Subject: **Licensee Event Report 50-259/2020-001-01 - Manual Reactor Shutdown of Two Units on Decreasing Condenser Vacuum due to Eel Grass Intrusion**

The enclosed Licensee Event Report (LER) provides details of the manual reactor shutdown of two units on decreasing condenser vacuum due to eel grass intrusion. The Tennessee Valley Authority is submitting this report in accordance with Title 10 CFR 50.73(a)(2)(iv)(A), as any event or condition that resulted in a manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B). The enclosed LER has been revised to update the cause of the event and the corrective actions.

There are no new regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact J. L. Paul, Site Licensing Manager, at (256) 729-2636.

Respectfully,

Matthew Rasmussen
Site Vice President

Enclosure: Licensee Event Report 50-259/2020-001-01 – Manual Reactor Shutdown of Two Units on Decreasing Condenser Vacuum due to Eel Grass Intrusion

cc (w/ Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant
NRC Project Manager - Browns Ferry Nuclear Plant

NRC FORM 366 (08-2020) | U.S. NUCLEAR REGULATORY COMMISSION | APPROVED BY OMB: NO. 3150-0104 | EXPIRES: 08/31/2023

LICENSEE EVENT REPORT (LER)

1. Facility Name	2. Docket Number	3. Page
Browns Ferry Nuclear Plant, Unit 1	05000259	1 OF 6

4. Title

Manual Reactor Shutdown of Two Units on Decreasing Condenser Vacuum due to Eel Grass Intrusion

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Revision No.	Month	Day	Year	Facility Name	Docket Number
07	20	2020	2020	- 001 -	01	11	17	2020	Browns Ferry Nuclear Plant, Unit 2	05000260
									Facility Name: N/A	Docket Number: 05000 N/A

9. Operating Mode	10. Power Level
1	100

11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*

10 CFR Part 20	☐ 20.2203(a)(2)(vi)	☐ 50.36(c)(2)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(A)	**10 CFR Part 73**
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.69(g)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(4)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(i)	**10 CFR Part 21**	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(1)
☐ 20.2203(a)(2)(ii)	☐ 21.2(c)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(i)
☐ 20.2203(a)(2)(iii)	**10 CFR Part 50**	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)	☐ 73.77(a)(2)(ii)
☐ 20.2203(a)(2)(iv)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)	
☐ 20.2203(a)(2)(v)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)	

☐ **OTHER** (Specify here, in abstract, or NRC 366A).

12. Licensee Contact for this LER

Licensee Contact	Phone Number (Include area code)
Denzel Housley, Licensing Engineer	256-729-7643

13. Complete One Line for each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable to IRIS	Cause	System	Component	Manufacturer	Reportable to IRIS
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

14. Supplemental Report Expected)		15. Expected Submission Date	Month	Day	Year
☒ No	☐ Yes (If yes, complete 15. Expected Submission Date		N/A	N/A	N/A

16. Abstract (Limit to 1560 spaces, i.e., approximately 15 single-spaced typewritten lines)

On July 20, 2020, at approximately 0955 Central Daylight Time (CDT), the Unit 1 control room received the traveling screen differential pressure high alarm. Assistant Unit Operators dispatched to the condenser circulating water (CCW) system forebay reported large masses of eel grass. The influx of eel grass resulted in fouling of the trash racks and traveling water screens for all three units which reduced the CCW flows during this event.

As a result of degrading condenser vacuum on Unit 2, operators manually scrammed the reactor at 1325 CDT. On July 21, 2020, as Unit 1 condenser vacuum continued to degrade to the turbine trip setpoint, the Unit 1 operators manually scrammed the reactor at 0435 CDT.

The root cause of the event is that existing permanently installed plant equipment at the BFN forebay was not adequate to mitigate the newly developed threat presented by large scale eel grass accumulation on Wheeler Lake.

The action plan for addressing the root cause of this event has been developed which consists of deciding which equipment upgrades will be the most effective based on studies of river flow and environmental conditions, funding these upgrades, issuing design packages, and implementing the final designs.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Browns Ferry Nuclear Plant, Unit 1	05000-259	2020	- 001	- 01

NARRATIVE

I. Plant Operating Conditions Before the Event

Prior to this event, all three Browns Ferry Nuclear Plant (BFN) Units were in Mode 1 at approximately 100 percent power.

II. Description of Event

A. Event Summary

On July 20, 2020, at approximately 0955 Central Daylight Time (CDT), the Unit 1 control room received the traveling screen [EIIS: SCN] differential pressure high alarm. Assistant Unit Operators (AUOs) dispatched to the condenser circulating water (CCW) system [EIIS: KE] forebay reported large masses of eel grass. The influx of eel grass resulted in fouling of the trash racks and traveling water screens for all three units which reduced the CCW flows during this event. Abnormal Operating Instructions (AOI) 0-AOI-27-1, "Component Biofouling," and 1/2/3-AOI-47-3, "Loss of Condenser Vacuum," were entered as required. Actions were taken to manipulate the CCW pumps and traveling water screens to clear the eel grass. Additionally, reactor power was reduced to compensate for the lowering main condenser [EIIS: SG] vacuum.

At 1315, as a result of degrading condenser vacuum on Unit 2, operators began lowering reactor power and as condenser vacuum continued to degrade to the turbine trip setpoint, the Unit 2 operators manually scrammed the reactor at 1325 CDT. Primary Containment Isolation System (PCIS) [EIIS: JM] Groups 2, 3, 6, and 8 containment isolation signals were received. Upon receipt of these signals all required components actuated as required. All safety systems operated as expected.

On July 21, 2020, as Unit 1 condenser vacuum continued to degrade to the turbine trip setpoint, the Unit 1 operators manually scrammed the reactor at 0435 CDT. PCIS Groups 2, 3, 6, and 8 containment isolation signals were received. Upon receipt of these signals all required components actuated as required. All safety systems operated as expected.

During this event, Unit 3 also experienced degraded condenser vacuum and was able to maintain reactor operation at a reduced reactor power of approximately 75 to 80%.

The Tennessee Valley Authority (TVA) is submitting this report in accordance with Title 10 CFR 50.73(a)(2)(iv)(A), as any event or condition that resulted in a manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B), including: the reactor protection system (RPS) [EIIS: JC] which includes a reactor scram or a reactor trip, and general containment isolation signals affecting containment isolation valves in more than one system.

B. Status of structures, components, or systems that were inoperable at the start of the event and that contributed to the event

At the start of this event, there were no structures, systems, or components (SSCs) whose inoperability contributed to this event.

C. Dates and approximate times of occurrences

Dates and Approximate Times (CDT)	Occurrence
July 20, 2020; 0955	Unit 1 received alarm TRAVELING SREEN DP HIGH
July 20, 2020; 1113	Unit 1 lowered reactor power due to degrading condenser vacuum
July 20, 2020; 1318	Unit 2 lowered reactor power due to degrading condenser vacuum
July 20, 2020; 1325	Unit 2 was manually scrammed at approximately 66% reactor power
July 20, 2020; 1711	NRC event notification report made for Unit 2 scram (EN 54794)
July 21, 2020; 0435	Unit 1 was manually scrammed at approximately 30% reactor power
July 21, 2020; 0758	NRC event notification report made for Unit 1 scram (EN 54795)
July 31, 2020	Unit 2 returned to 100% power
August 3, 2020	Unit 1 returned to 100% power

D. Manufacturer and model number of each component that failed during the event

There was no failure of a component for this event.

E. Other systems or secondary functions affected

There were no other systems or secondary functions affected.

F. Method of discovery of each component or system failure or procedural error

The event was self-revealing when the control room received the traveling screen differential pressure high alarm.

G. The failure mode, mechanism, and effect of each failed component

There was no failure of a component for this event.

H. Operator actions

Operations personnel reduced reactor power and initiated manual reactor scrams on BFN Units 1 and 2 due to decreasing condenser vacuum. Appropriate operator actions were taken in response to the scrams and recovery from the scrams.

I. Automatically and manually initiated safety system responses

The BFN Units 1 and 2 reactors were manually scrammed due to the decreasing condenser vacuum. As expected, PCIS Groups 2, 3, 6, and 8 isolations were received due to low reactor water level. Upon receipt of the PCIS signals, all components actuated as required.

III. Cause of the event

A. Cause of each component or system failure or personnel error

The direct cause of the manual reactor shutdowns was degraded main condenser vacuum.

The root cause of the event is that existing permanently installed plant equipment at the forebay was not adequate to mitigate the newly developed threat presented by large scale eel grass accumulation on Wheeler Lake.

A contributing cause of the event is that Nuclear Power Group (NPG) procedures for risk based decisions are not aligned with industry standards and are not consistently implemented.

B. Cause(s) and circumstances for each human performance related root cause

The root cause of this event was not human performance related.

IV. Analysis of the event

In 2019, eel grass growth and breakaway resulting in accumulation in the forebay became a new problem for BFN and the generational risk was quickly identified. A number of actions were put in place to mitigate the risk of this problem.

A rapid surge of eel grass accumulation occurred on July 20, 2020 that was beyond the capability of plant personnel and equipment to mitigate. BFN Units 1 and 2 were manually scrammed (on

July 21, 2020, and July 20, 2020, respectively) in response to decreasing condenser vacuum and Unit 3 power was reduced.

V. Assessment of Safety Consequences

The RPS provides timely protection against the onset and consequences of conditions that threaten the integrity of the fuel barrier and the nuclear system process barrier, i.e., fuel cladding and Reactor Coolant System pressure boundary, respectively. The function of the RPS is to initiate a reactor scram when one or more monitored parameters exceed their specified limits to preserve the integrity of the fuel cladding and the Reactor Coolant System and minimize the energy that must be absorbed following a loss of coolant accident. This can be accomplished either automatically or manually. In response to this condition, Operations personnel identified the decreasing condenser vacuum and initiated a manual reactor scram on Units 1 and 2. The plant responded as designed and all safety systems remained in a standby readiness configuration. There were no Emergency Core Cooling System (ECCS) [EIIS: BJ, BO, BM] or Reactor Core Isolation Cooling System [EIIS: BN] reactor water level initiation set points reached and PCIS Groups 2, 3, 6, and 8 signals were received as expected. Upon receipt of these signals, all required components actuated as required.

Safe shutdown conditions were established and maintained. Therefore, TVA concluded that there was minimal safety significance for this event.

A. Availability of systems or components that could have performed the same function as the components and systems that failed during the event

All systems responded as expected to the manual scrams.

B. For events that occurred when the reactor was shut down, availability of systems or components needed to shutdown the reactor and maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident

This event did not occur when the reactor was shutdown.

C. For failure that rendered a train of a safety system inoperable, estimate of the elapsed time from discovery of the failure until the train was returned to service

There were no safety systems rendered inoperable as a result of this event.

VI. Corrective Actions

Corrective Actions are being managed by the TVA's corrective action program under Condition Report (CR) 1624488.

A. Immediate Corrective Actions

1. Actions were taken to rake trash racks, clean traveling water screens, and reduce reactor power.

2. An Operations Decision-Making Issue (ODMI) evaluation was developed to provide critical thinking and additional guidance for unit restart. The ODMI evaluation included actions such as assessing CCW system health, increased monitoring, and increased staffing for harvester operation & trash rack cleaning.

B. Corrective Actions to Prevent Recurrence or to reduce the probability of similar events occurring in the future

1. The action plan for addressing the root cause of this event has been developed which consists of deciding which equipment upgrades will be the most effective based on studies of river flow and environmental conditions, funding these upgrades, issuing design packages, and implementing the final designs.

2. There are several new procedures and revisions that will correct the procedural aspect of the contributing cause. NPG procedures for risk based decisions will be revised using industry leaders as a model. NPG will create new or revise existing risk management procedures to incorporate industry best integrated risk management standards. These changes will include a consequence-based approach to risk management and will assess risk that accounts for unknown factors so that the site can actively address the risk instead of reacting as the consequences of the risk manifests itself and forces the plant into taking actions. Additional site procedures will be revised as tracked by CR 1624488.

VII. Previous Similar Events at the Same Site

A search of BFN Licensee Event Reports (LERs) for Units 1, 2, and 3 within the last three years identified no LERs associated with biofouling at the CCW system intake.

In 2019, eel grass growth and breakaway resulting in accumulation in the forebay became a new problem for BFN and the generational risk was quickly identified. Evaluation of this issue and resultant actions are being tracked by CR 1563233.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
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NARRATIVE

VIII. Additional Information

There is no additional information.

IX. Commitments

There are no new commitments.